इंटरनेट मानक

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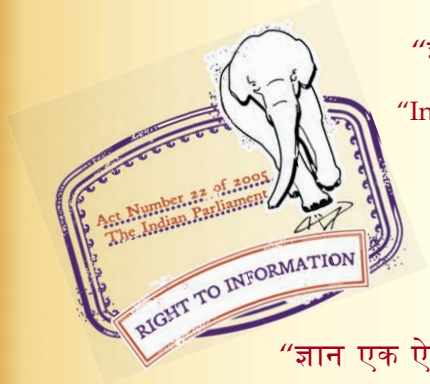
"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 5443 (1994): High speed steel reamers - Technical supply conditions [PGD 32: Cutting tools]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS 6443 : 1994

भारतीय मानक

हाई स्पीड इस्पात रीमर — तकनीकी पूर्ति शर्तें

(दूसरा पुनरीक्षण)

Indian Standard

HIGH SPEED STEEL REAMERS — TECHNICAL SUPPLY CONDITIONS

(Second Revision)

UDC 621·951·7 [669·14·018·25·2·3] : 006·87

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

June 1994

Price Group 8

Drills and Reamers Sectional Committee, PE 10

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Drills and Reamers Sectional Committee had been approved by the Production Engineering Division Council.

This standard was first published in 1969 and subsequently revised in 1984. The committee responsible for its preparation decided to update the standard in the light of experience gained over the years. Some of the modifications incorporated in this revision are as follows

i) Reference clause has been included.

ii) Figure of 'Machine jig reamer' has been modified

iii) Definition for 'Bevel lead' has been modified.

iv) Definition for 'Pilot' has been deleted.

v) Figures for 'Straight flute socket reamer with parallel shank and morse taper shank' have been deleted.

vi) Definition of 'Chip breakers' and 'Irregular spacing' have been included.

vii) Requirements of hardness on tang of morse taper shank has been included

viii) Run out tolerance on 'Shell reamer' has been included.

ix) Annex B has been updated.

In the preparation of this standard, considerable assistance has been derived from the following standards:

DIN 2172/1-1979 'Technical specifications for reamers with shank'

DIN 2172/2-1979 'Reamers technical specification for shell', issued by Deutsche Institut fur Normung (DIN).

ISO 5420-1983 'Reamers — Terms, definitions and types', issued by International Organization for Standardization (ISO).

Technical Committee responsible for the formulation of this standard is given in Annex D

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 1 SEPTEMBER 1995
TO
IS 5443 : 1994 HIGH SPEED STEEL REAMERS — TECHNICAL SUPPLY CONDITIONS

(Second Revision)

(*Page* 1, *clause* 1.2.2) — Substitute '*IS 5446 : 1978*' *for* '*IS 4546 : 1978*'.

(*Page* 1, *clause* 3.2.4) — Substitute 'taper shank' *for* 'tapper shank'.

(*Page* 6, *clause* 3.3.17) — Substitute 'continuity' *for* 'countinuity'.

[*Page* 7, *clause* 4(b) (i)] — Substitute 'High' *for* 'Hige'.

[*Page* 8, *clause* 5(b) (iii)] — Substitute '300 HV *Min*' *for* '300 HV *Max*'.

(*Page* 8, *clause* **6.1**, *second line*) — Insert 'm6' after the words 'Reamer with'.

(*Page* 11, *Annex A*) — Substitute 'IS 5568 : 1978' *for* 'IS 5568 : 1968' and 'IS 5919 : 1978' *for* 'IS 5919 : 1971'

(*Page* 12, *Annex B*, *col* 7) — Substitute 'B11' *for* 'C11'.

(*Page* 12, *Annex B*, *col* 9, *Row* 12) — Substitute

'+285'	*for*	'+265'
+250		+250

(*Page* 13, *Annex B*, *col* 5, *Row* 6) — Substitute

'+113'	*for*	+113'
+ 99		+ 98

(*Page* 14, *Annex B*, *col* 7, *Row* 2) — Substitute

'+40	*for*	+40'
+23		+43

(*Page* 17, *Annex B*, *col* 2, *Row* 15) — Substitute '160' *for* '140'.

(*Page* 19, *Annex C*, *last line*) — Substitute '12.015' *for* '12.315'.

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 MARCH 2001
TO
IS 5443 : 1994 HIGH SPEED STEEL REAMERS — TECHNICAL SUPPLY CONDITIONS

(Second Revision)

(*Page* 8, *clause* **6.6**) — Insert the following new clause after **6.6**:

'**6.7** Cone tolernace shall be to Grade AT6 according to IS 7615, for Morse Taper Shanks.'

Reprography Unit, BIS, New Delhi, India

Indian Standard

HIGH SPEED STEEL REAMERS — TECHNICAL SUPPLY CONDITIONS

(Second Revision)

1 SCOPE

This Indian Standard covers the terminology and general requirements for High Speed Steel Reamers.

2 REFERENCES

The Indian Standards listed in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

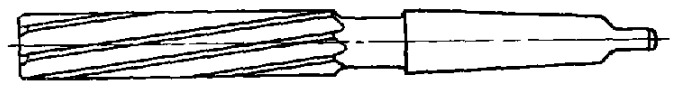
3.1 Reamer

A tool used for enlarging or finishing to size, a previously formed hole.

3.2 Types of Reamers

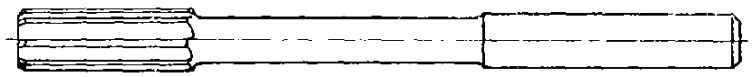
3.2.1 *Long Fluted Machine Reamers with Morse Taper Shank (IS 5445 1978)*

A reamer having virtually parallel cutting edges with bevel lead and integral with morse taper shank for holding and driving. The flutes shall be straight or helical.



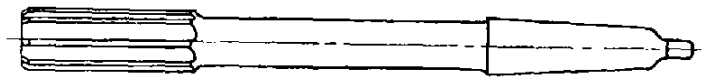
3.2.2 *Machine Chucking Reamer with Parallel Shank (IS 4546 . 1978)*

A reamer with short virtually parallel cutting edges with bevel lead and long body recess between shank and cutting edge integral with parallel shank for holding and driving The flutes shall be straight or helical.



3.2.3 *Machine Chucking Reamer with Morse Taper Shank (IS 5447 . 1978)*

A reamer with short virtually parallel cutting edges with bevel lead and long body recess between shank and cutting edges integral with a morse taper shank for holding and driving. The flutes shall be straight or helical.

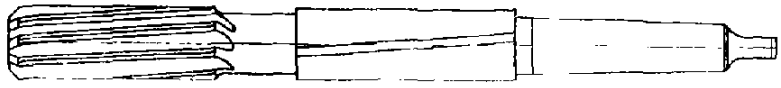


3.2.4 *Machine Bridge Reamer (IS 5919 . 1978)*

A reamer having virtually parallel cutting edges with a long lead integral with morse tapper shank for holding and driving. The flutes shall be straight or helical.

3.2.5 *Machine Jig Reamer with Morse Taper Shank (IS 11002 . 1984)*

A reamer having short, virtually parallel cutting edges with bevel lead and a guide between the shank and cutting edges integral with a morse taper shank for holding and driving. The flutes shall be helical.

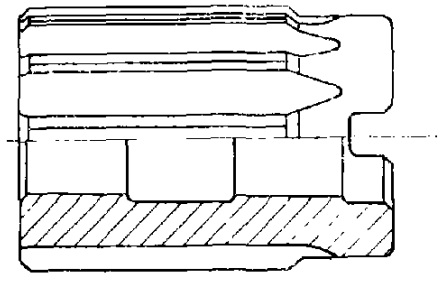


3.2.6 *Parallel Hand Reamer with Parallel Shank (IS 5444 1978)*

A reamer having virtually parallel cutting edges with taper and bevel lead and integral with a shank of nominal diameter of the cutting edges, and a driving square on the end. The flutes may be straight or helical.

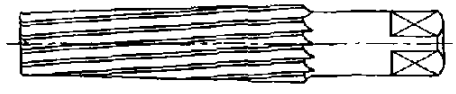
3.2.7 *Shell Reamer (IS 5926 1970)*

A short reamer with an axial taper hole generally 1 30 with a cross slot for use on an arbor, and having parallel cutting edges with bevel lead. The flutes shall be straight or helical



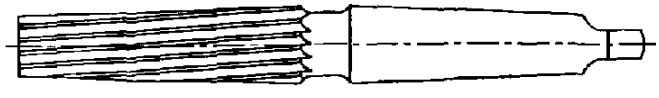
3.2.8 *Socket Reamer with Parallel Shank (IS 5882 1970)*

A reamer having taper cutting edges for holes to suit metric and morse tapers integral with parallel shank and a driving square on the end. The flutes shall be straight or helical.



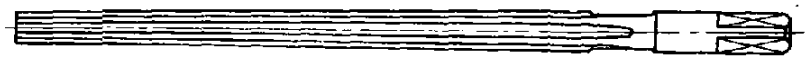
3 2.9 *Socket Reamers with Morse Taper Shank (IS 5907 1970)*

A reamer having taper cutting edges for holes to suit metric and morse tapers integral with morse taper shank. The flutes may be straight or helical



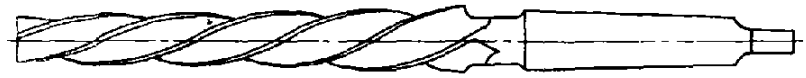
3.2.10 *Taper Pin Hand Reamers (IS 5881 1984)*

A reamer having taper cutting edges for holes to suit pins with taper of 1 : 50 integral with a parallel shank and driving square on the end. The flutes shall be straight or helical.



3.2.11 *Taper Pin Machine Reamer with Morse Taper Shank (IS 5918 1984)*

A reamer having taper cutting edges for holes to suit pins with a taper of 1 : 50 integral with a morse taper shank for holding and driving. The flutes shall be straight or helical



3.2.12 *Taper Pin Machine Reamer with Parallel Shank (IS 10851 : 1984)*

A reamer having taper cutting edges for holes to suit pins with a taper of 1 . 50 integral with a parallel shank for holding and driving The flutes shall be straight or helical.

3.3 Elements (*See* Fig 1 and 2)

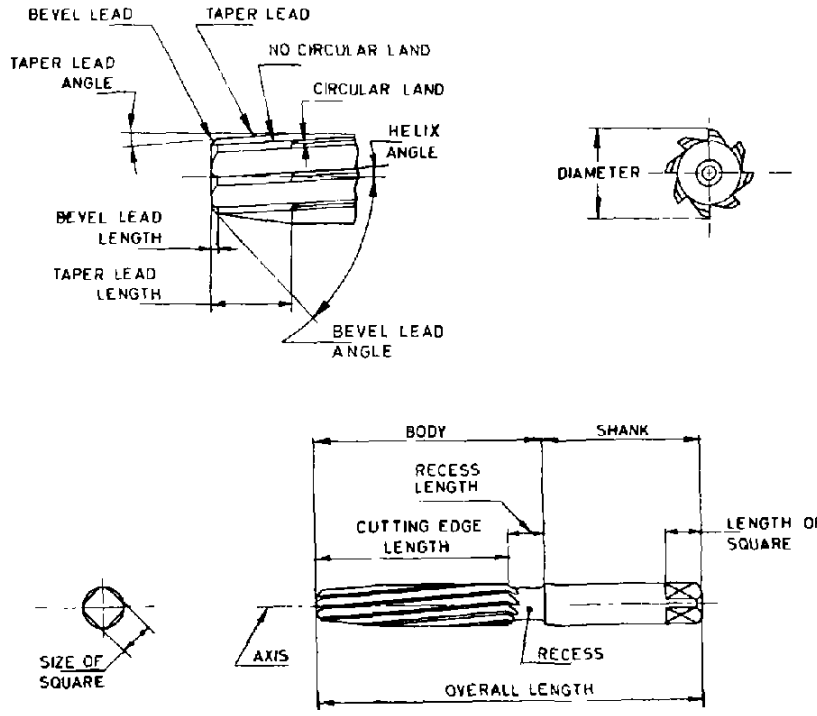


FIG. 1 TERMS RELATING TO REAMERS

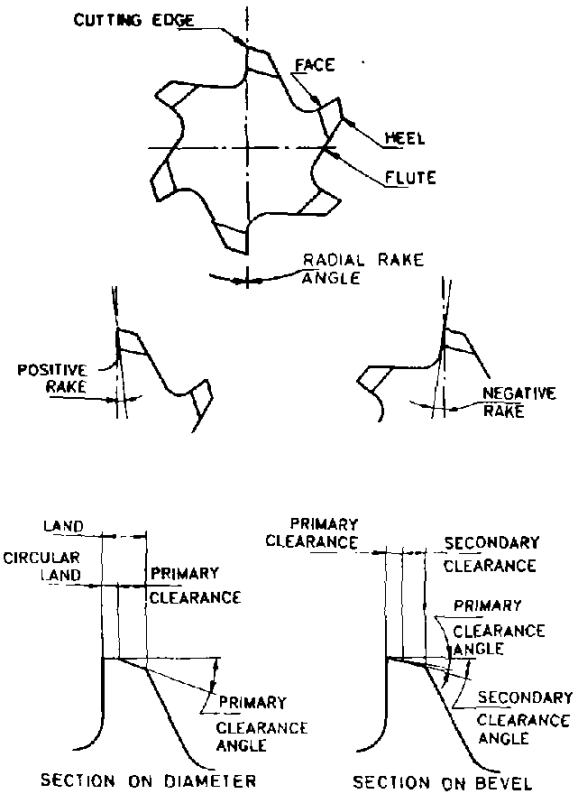


FIG. 2 TERMS RELATING TO CUTTING GEOMETRY OF REAMERS

3.3.1 *Axis*

The longitudinal centre line of the reamer.

3.3.2 *Back Taper*

The reduction in diameter of reamer from the entering end towards the shank.

3.3.3 *Bevel Lead*

The angular cutting portion at the entering end of the reamer. It is not provided with circular land.

3.3.4 *Body*

The portion of the reamer extending from the entering end of the reamer to the commencement of the shank.

3.3.5 *Circular Land*

The cylindrically ground surface adjacent to the cutting edge on the leading edge of the land.

3.3.6 *Clearance*

3.3.6.1 *Primary*

That portion of the land removed to provide clearance immediately behind the cutting edge or behind circular land.

3.3.6.2 *Secondary*

That portion of the land removed to provide clearance behind the primary clearance.

3.3.7 *Cutting Edge*

The edge formed by the intersection of the face and the circular land or the surface left by the provision of primary clearance.

3.3.8 *Face*

That portion of the flute surface adjacent to the cutting edge on which the chip impinges as it is cut from the work.

3.3.9 *Flutes*

The grooves in the body of the reamer to provide cutting edges, to permit the removal of chips, and to allow cutting fluid to reach the cutting edges.

3.3.10 *Guide*

A cylindrically ground portion of the body between the cutting edges and the shank to keep the reamer in alignment.

3.3.11 *Heel*

The edge formed by the intersection of the surface left by the provision of secondary clearance and the flute.

3.3.12 *Land*

That portion of the fluted body left standing between the flutes, the surface or the surfaces included between the cutting edge and the heel.

3.3.13 *Recess*

The portion of the body which is reduced in diameter below the cutting edges, guide diameters or shank diameters.

3.3.14 *Rotation of Cutting*

3.3.14.1 *Right hand cutting reamer*

A reamer which cuts while rotating in an anticlockwise direction when viewed on the entering end of the reamer.

3.3.14.2 *Left hand cutting reamer*

A reamer which cuts while rotating in a clockwise direction when viewed on the entering end of the reamer.

3.3.15 *Shank*

That portion of the reamer by which it is held and driven. It shall be parallel or taper.

3.3.15.1 *Parallel shank for hand reamer*

A cylindrically ground shank provided with driving square at its extreme end for driving the reamer.

3.3.15.2 *Parallel shank for machine use*

A cylindrically ground shank normally without a driving square.

3.3.15.3 *Taper shank*

A shank of recognized standard taper for machine use and holding.

3.3.16 *Taper Lead*

The tapered cutting portion at the entering end to facilitate cutting and finishing of the hole. It is not provided with a circular land.

3.3.17 *Chip Breakers*

Notches or grooves in the cutting edges of Roughing Taper Reamers designed to break the countinuity of the chips.

3.3.18 *Irregular Spacing*

A deliberate variation from uniform spacing of the reamer cutting edges.

3.4 Linear Dimensions

3.4.1 *Bevel Lead Length*

The length of the bevel lead measured axially.

3.4.2 *Cutting Edge Length*

The axial length of that portion of the fluted body provided with primary clearances or circular lands and including the taper and bevel leads.

3.4.3 *Cutting Diameter*

The maximum cutting diameter of the reamer at the entering end.

3.4.4 *Cross Slot Depth*

The overall depth of the slot measured from the rear end of the shell reamer to the root of the radiused slot (*see* IS 5568 : 1978).

3.4.5 *Cross Slot Width*

The width of the slot in the rear end of the shell reamer (*see* IS 5568 : 1978).

3.4.6 *Bore of the Shell Reamer*

That portion of the shell reamer to suit an arbor on which the arbor is mounted.

3.4.6.1 *Parallel bore diameter*

The diameter of the bore of the shell reamer to suit a parallel arbor on which the reamer is mounted.

3.4.6.2 *Taper bore, large end diameter*

The largest diameter of the taper bore of the shell reamer at the rear end of the reamer.

3.4.6.3 *Taper bore, small end diameter*

The small end diameter of the taper bore of the shell reamer at the entering end of the reamer.

NOTE — A taper hole is defined for size by stating the large end diameter and the including angle of the taper, or as a taper ratio, namely, 1 in 30 (included)

3.4.7 *Large End Diameter*

The maximum diameter over the tapered cutting edges of a taper reamer.

3.4.8 *Lead of Helix*

The axial distance measured parallel to the reamer axis between corresponding points on the leading edges of the land in one complete revolution of flute.

3.4.9 *Length of Square*

The length of the squared portion at the extreme end of a parallel shank.

3.4.10 *Overall Length*

The length over the extreme ends of the reamer.

3.4.11 *Recess Length*

The length of that portion of body which is reduced in diameter below the cutting edges, guide diameters or shank diameter.

3.4.12 *Size of Square*

The dimensions across the flats of the squared portion at the extreme end of a parallel shank.

3.4.13 *Small End Diameter*

The minimum diameter over the tapered cutting edges of a taper reamer.

3.4.14 *Taper Lead Length*

The length of the taper lead measured axially.

3.5 Angles

3.5.1 *Bevel Lead Angle*

The angle formed by the cutting edges of the bevel lead and the reamer axis.

3.5.2 *Clearance Angle*

The angles formed by the primary or secondary clearances and the tangent to the periphery of the reamer at the cutting edge. They are called primary clearance angle and secondary clearance angle, respectively.

3.5.3 *Helix Angles*

The angle between the cutting edge and the reamer axis.

3.5.4 *Included Angle of Taper*

The angle between diametrically opposite cutting edges of the taper reamer. This is designated as a taper ratio, for example, 1 in 50 (included), or as the included angle of the taper.

3.5.5 *Rake Angles*

The angles, in a diametral plane, formed by the face and a radial line from the cutting edge.

3.5.5.1 *Radial rake angle*

If the face and the radial line coincide, then the rake angle is zero degree and the rake is called radial rake.

3.5.5.2 *Positive rake angle*

If the angle formed by the face and the radial line, falls behind the radial line in relation to the direction of cut, then the rake angle is called positive rake.

3.5.5.3 *Negative rake angle*

If the angle formed by the face and the radial line, falls in front of the radial line in relation to the direction of cut, then the rake angle is called negative rake.

3.5.6 *Taper Lead Angle*

The angle formed by the cutting edges of the taper lead and the reamer axis.

4 MATERIAL

a) One piece construction — High speed steel.

b) Two piece construction

i) Cutting portion — Hige speed steel.

ii) Shank portion — Carbon steel having tensile strength not less than 700 MPa (before construction).

NOTE — Unless otherwise specified, the high speed steel shall be of designation XT87W6Mo5Cr4V2 or XT72W18Cr4V1 according to IS 7291 : 1981 or equivalent in which case the major constituents shall be specified by the manufacturer

5 HARDNESS

a) Cutting portion	760 HV *Min* 900 HV *Max*
b) Shank portion	
i) Parallel shank	
One piece construction	240 HV *Min* (Maximum hardness shall not exceed the hardness of the cutting portion)
Two piece construction	185 HV *Min* 450 HV *Max*

ii) Morse taper shank	185 HV *Min* (after construction)
iii) Tang of morse taper shank	
For reamer of dia below 10 mm	185 HV *Min*
For reamer of dia 10 mm and above	300 HV *Max* 450 HV *Max*
iv) Driving tenon	
One piece construction	240 HV *Min* (Maximum hardness shall not exceed the hardness of the cutting portion)
Two piece construction	240 HV *Min* 450 HV *Max*

NOTE — The hardness shall be checked at HV 10/HV 30 load

5.1 The hardness of the cutting portion shall be determined by the circular land. Alternatively, the hardness may be checked by the flat portion of the cutting end.

6 TOLERANCES

6.1 Unless otherwise specified, the diameter of the cutting portion of reamer shall have a tolerance m6. Reamers with tolerance are expected to produce H8 holes, and by selection will also be suitable for H7 holes [*see* IS 919 (Parts 1 and 2) : 1993].

6.2 The limits of tolerance on the diameter of cutting portion of reamer for commonly used holes are given in Annex B.

6.3 For the manufacture of reamers other than required for producing H8 holes and commonly used holes covered in Annex B, it is recommended that the limits of tolerance on the diameter of the cutting portion of reamer in relation to those of the holes to be produced, shall be determined as given in Annex C

6.4 Tolerances on other reamer dimensions shall be specified in the relevant Indian Standards.

6.5 Tolerances on length of square of the reamers shall be as given in Table 1.

Table 1 Tolerances on Length of Square

All dimensions in millimetres

Length of Square		Tolerances
Over	Up to	
—	5	± 0.5
5	20	± 1.0
20	40	± 1.5
40	—	± 2.0

6.6 Run Out Tolerances

The run out tolerances for hand reamers, machine reamers and shell reamers shall be as given in Table 2 read with Fig. 3, 4 and 5.

NOTE — For measuring the run out, the hand reamers and machine reamers are mounted between centres (*see* Fig. 3 and 4) and the shell reamers are mounted between centres using a test mandrel (*see* Fig 5) and the gauge is engaged on the surface at the required test point The run out is determined as the total deviation of the gauge reading when the reamer is turned fully, that is difference between the maximum and minimum reading. For shell reamer the radial run out of the test mandrel should be subtracted from the radial run out tolerance.

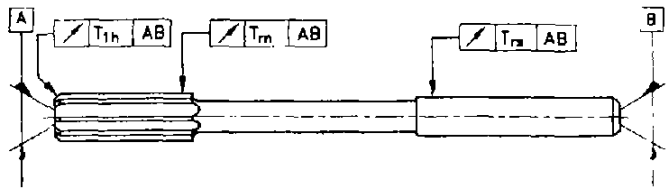


FIG. 3 RUN OUT TOLERANCES FOR REAMERS WITH PARALLEL SHANK

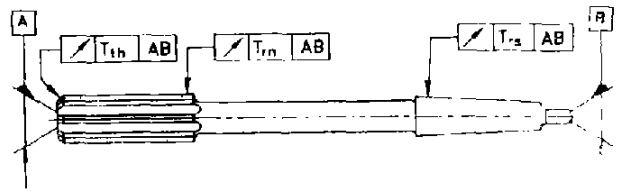


FIG 4 RUN OUT TOLERANCES FOR REAMERS WITH MORSE TAPER SHANK

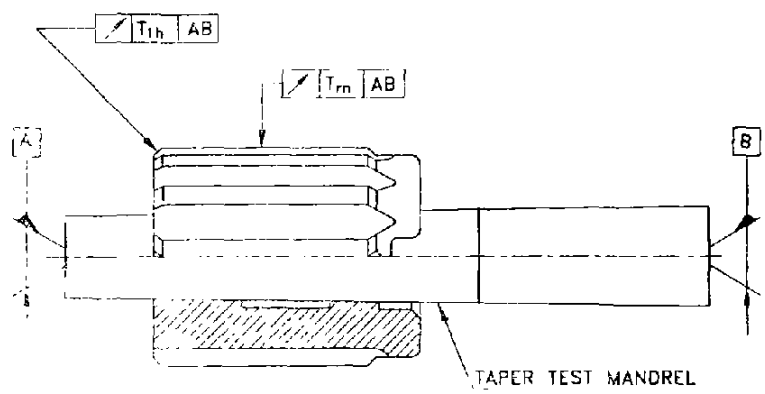


FIG. 5 RUN OUT TOLERANCES FOR SHELL REAMERS

7 GENERAL REQUIREMENTS

7.1 Cutting edges of reamers above 3 mm diameter shall be properly relieved and backed off, and shall have a positive or zero rake. Unless otherwise specified, reamers shall be supplied with positive rake

7.2 Unequal spacing of teeth is recommended but cutting edges of all pairs of teeth shall be diametrically opposite for the purpose of measurement.

7.3 The high speed steel reamers shall have a back taper at the rate of 0·010 to 0·020 on dia per 100 mm cutting edge length portion up to 30 mm diameter and 0 020 to 0·030 per 100 mm length for sizes above 30 mm diameter.

7.4 Morse taper shanks shall be according to IS 1715 : 1986.

7.5 Driving squares shall be according to IS 1850 : 1961.

7.6 Centre holes shall be according to IS 2473 : 1975.

Table 2 Run Out Tolerances

(*Clause* 6.6; Fig. 3, 4 *and* 5)

All dimensions in millimetres

Reamer Diameter		Shell Reamer and Machine Reamer with Parallel and Taper Shank			Hand Reamer
Over	Up to and Including	On Bevel Edge T_{1h}	On Diameters T_{rn}	On Shank Diameter T_{rs}	On Taper Lead T_{1h}
1	3	0 020	0 005	0 010	0 030
3	6	0 020	0 006	0 012	0 030
6	10	0 025	0 008	0 015	0 030
10	18	0 025	0 008	0 018	0 036
18	30	0 030	0 009	0 021	0 042
30	50	0 030	0 011	0 025	0 050
50	80	0 040	0 013	0 030	0 060
80	120	0 040	0 015	—	—

NOTES

1 The test values shall apply only for standard reamer lengths and correspond

2 For T_{rn} to the tolerance series IT5

3 For T_{rs}, to the tolerance series IT7

4 For T_{1h} on hand reamers, to double the values of the tolerance series IT7, but not less than 0 030

7.7 In case of small size reamers where male centres are provided on either or both ends, these lengths shall not be taken into account for measurement of flute length or overall length.

8 MARKING

Reamers with diameter over 2 mm shall be marked with the following

a) Cutting diameter,

b) Zone of hole tolerance, and

c) The manufacturer's name or trade-mark.

8.1 The marking may be etched, stamped or electrically affixed, but it shall not affect the clamping and other functional characteristics of the tool.

8.2 BIS Certification Marking

The product may be marked with Standard Mark

8.2.1 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

9 PROTECTIVE COATING AND PACKING

9.1 Each reamer shall be covered with a suitable rust proofing material and the cutting portion shall be protected against damage.

9.2 Each reamer or a number of reamers, shall be wrapped in Type 2 waxed grease proof paper according to IS 3962 : 1967 protected by a cover bearing the type, cutting diameter, material, R or L for right-hand or left-hand cutting and manufacturer's name, initials or trade-mark.

9.3 Only one size of reamers shall be packed in one carton.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
919 (Part 1) . 1993	ISO system of limits and fits : Part 1 Basis of tolerances, deviations and fits
919 (Part 2) : 1993	ISO system of limits and fits : Part 2 Tables of standard tolerance grades and limit deviation for holes and shafts
1715 · 1986	Dimensions for self holding tapers (*second revision*)
1850 : 1961	Dimensions for shank diameters and driving squares for rotating tools
2473 . 1975	Dimensions for centre holes (*first revision*)
3962 : 1967	Waxed paper for general packaging
5444 : 1978	Parallel hand reamers with parallel shanks (*first revision*)
5445 : 1978	Long fluted machine reamers with morse taper shank (*first revision*)
5446 : 1978	Machine chucking reamers with parallel shanks (*first revision*)
5447 . 1978	Machine chucking reamers with morse taper shank (*first revision*)
5568 : 1968	Dimensions for tenons and cross slots with taper bore 1 30
5881 : 1984	Taper pin hand reamers (*first revision*)
5882 : 1970	Socket reamers with parallel shanks
5907 : 1970	Socket reamers with morse taper shanks
5918 : 1984	Taper pin, machine reamers with morse taper shanks (*first revision*)
5919 : 1971	Machine bridge reamers (*first revision*)
5926 : 1970	Shell reamers
7291 : 1981	High speed steels (*first revision*)
10851 : 1984	Taper pin machine reamers with parallel shanks
11002 : 1984	Machine jig reamers morse taper shank

ANNEX B

(*Clause* 6.2)

LIMITS OF TOLERANCES FOR REAMERS

Range of Diameters mm		Maximum and *Minimum Limits* of Tolerance on Nominal Diameter for Reamer for Commonly Used Holes Values in μm							
Over	Up to and Including	A9	A11	B8	B9	C11	C8	C9	C11
1	3	+ 291 + 282	+ 321 + 300	+ 151 + 146	+ 161 + 152	+ 191 + 170	+ 71 + 66	+ 81 + 72	+ 111 + 90
3	6	+ 295 + 284	+ 333 + 306	+ 155 + 148	+ 165 + 154	+ 203 + 176	+ 85 + 78	+ 95 + 84	+ 133 + 106
6	10	+ 310 + 297	+ 356 + 324	+ 168 + 160	+ 180 + 167	+ 226 + 194	+ 98 + 90	+ 110 + 97	+ 156 + 124
10	18	+ 326 + 310	+ 383 + 344	+ 172 + 162	+ 186 + 170	+ 243 + 204	+ 117 + 107	+ 131 + 115	+ 188 + 149
18	30	+ 344 + 325	+ 410 + 364	+ 188 + 176	+ 204 + 185	+ 270 + 224	+ 138 + 126	+ 154 + 135	+ 220 + 174
30	40	+ 362 + 340	+ 446 + 390	+ 203 + 189	+ 222 + 200	+ 306 + 250	+ 153 + 139	+ 172 + 150	+ 256 + 200
40	50	+ 372 + 350	+ 456 + 400	+ 213 + 199	+ 232 + 210	+ 316 + 260	+ 163 + 149	+ 182 + 160	+ 266 + 210
50	65	+ 402 + 376	+ 501 + 434	+ 229 + 212	+ 252 + 226	+ 351 + 284	+ 179 + 162	+ 202 + 176	+ 301 + 234
65	80	+ 422 + 396	+ 521 + 454	+ 239 + 222	+ 262 + 236	+ 361 + 294	+ 189 + 172	+ 212 + 186	+ 311 + 244
80	100	+ 453 + 422	+ 567 + 490	+ 265 + 246	+ 293 + 262	+ 407 + 330	+ 215 + 196	+ 243 + 212	+ 357 + 280
100	120	+ 483 + 452	+ 597 + 520	+ 285 + 266	+ 313 + 282	+ 427 + 350	+ 225 + 206	+ 253 + 222	+ 367 + 290
120	140	+ 545 + 510	+ 672 + 584	+ 313 + 290	+ 345 + 310	+ 472 + 384	+ 253 + 230	+ 265 + 250	+ 412 + 324
140	160	+ 605 + 570	+ 732 + 644	+ 333 + 310	+ 365 + 330	+ 492 + 404	+ 263 + 240	+ 295 + 260	+ 422 + 334
160	180	+ 665 + 630	+ 792 + 704	+ 363 + 340	+ 395 + 360	+ 522 + 434	+ 283 + 260	+ 315 + 280	+ 442 + 354

Range of Diameters mm		Maximum and Minimum Limits of Tolerance on Nominal Diameter for Reamer for Commonly Used Holes Values in μm															
Over	Up to and Including	D6	D7	D8	D9	D10	D11	E6	E7	E8	E9	E10	F6	F7	F8	F9	G6	G7
1	3	+ 25 + 22	+ 28 + 24	+ 31 + 26	+ 41 + 32	+ 54 + 40	+ 71 + 50	+ 19 + 16	+ 22 + 18	+ 25 + 20	+ 35 + 26	+ 48 + 34	+ 11 + 8	+ 14 + 10	+ 17 + 12	+ 27 + 18	+ 7 + 4	+ 10 + 6
3	6	+ 36 + 33	+ 40 + 35	+ 45 + 38	+ 55 + 44	+ 70 + 53	+ 93 + 66	+ 26 + 23	+ 30 + 25	+ 35 + 28	+ 45 + 34	+ 60 + 43	+ 16 + 13	+ 20 + 15	+ 25 + 18	+ 35 + 24	+ 10 + 7	+ 14 + 9
6	10	+ 47 + 43	+ 52 + 46	+ 58 + 50	+ 70 + 57	+ 89 + 68	+ 116 + 84	+ 32 + 28	+ 37 + 31	+ 43 + 35	+ 55 + 42	+ 74 + 53	+ 20 + 16	+ 25 + 19	+ 31 + 23	+ 43 + 30	+ 12 + 8	+ 17 + 11
10	18	+ 59 + 55	+ 65 + 58	+ 72 + 62	+ 86 + 70	+ 109 + 84	+ 143 + 104	+ 41 + 37	+ 47 + 40	+ 54 + 44	+ 68 + 52	+ 91 + 66	+ 25 + 21	+ 31 + 24	+ 38 + 28	+ 52 + 36	+ 15 + 11	+ 21 + 14
18	30	+ 76 + 71	+ 82 + 74	+ 93 + 81	+ 109 + 90	+ 136 + 106	+ 175 + 129	+ 51 + 46	+ 57 + 49	+ 68 + 56	+ 84 + 65	+ 111 + 81	+ 31 + 26	+ 37 + 29	+ 48 + 36	+ 64 + 45	+ 18 + 13	+ 24 + 16
30	50	+ 93 + 87	+ 101 + 92	+ 113 + 98	+ 132 + 110	+ 165 + 130	+ 216 + 160	+ 63 + 57	+ 71 + 62	+ 83 + 69	+ 102 + 80	+ 135 + 100	+ 38 + 32	+ 46 + 37	+ 58 + 44	+ 77 + 55	+ 22 + 16	+ 30 + 21
50	80	+ 116 + 109	+ 125 + 114	+ 139 + 122	+ 162 + 136	+ 202 + 160	+ 261 + 194	+ 76 + 69	+ 85 + 74	+ 99 + 82	+ 122 + 96	+ 162 + 120	+ 46 + 39	+ 55 + 44	+ 69 + 52	+ 92 + 66	+ 26 + 19	+ 35 + 24
80	120	+ 138 + 130	+ 149 + 136	+ 165 + 146	+ 193 + 162	+ 239 + 190	+ 307 + 230	+ 90 + 82	+ 101 + 88	+ 117 + 98	+ 145 + 114	+ 191 + 142	+ 54 + 46	+ 65 + 52	+ 81 + 62	+ 109 + 78	+ 30 + 22	+ 41 + 28
120	180	+ 166 + 157	+ 179 + 165	+ 198 + 175	+ 230 + 195	+ 281 + 225	+ 357 + 269	+ 106 + 97	+ 119 + 105	+ 138 + 115	+ 170 + 135	+ 221 + 165	+ 64 + 55	+ 77 + 63	+ 96 + 73	+ 128 + 93	+ 35 + 26	+ 48 + 34

Range of Diameters mm		Maximum and Minimum Limits of Tolerance on Nominal Diameter for Reamer for Commonly Used Holes Values in µm													
Over	Up to and Includ-ing	H6	H7	H8	H9	H10	H11	H12	J6	J7	J8	JS6	JS7	JS8	JS9
1	3	+ 5 + 2	+ 8 + 4	+ 11 + 6	+ 21 + 12	+ 34 + 20	+ 51 + 30	+ 85 + 50	+ 1 − 2	+ 2 − 2	+ 3 − 2	+ 2 − 1	+ 3 − 1	+ 4 − 1	+ 8 − 1
3	6	+ 6 + 3	+ 10 + 5	+ 15 + 8	+ 25 + 14	+ 40 + 43	+ 63 + 36	+ 102 + 60	+ 3 0	+ 4 − 1	+ 7 0	+ 2 − 1	+ 4 − 1	+ 6 − 1	+ 10 − 1
6	10	+ 7 + 3	+ 12 + 6	+ 18 + 10	+ 30 + 17	+ 49 + 28	+ 76 + 44	+ 127 + 74	+ 3 − 1	+ 5 − 1	+ 8 0	+ 3 − 1	+ 5 − 1	+ 7 − 1	+ 12 − 1
10	18	+ 9 + 5	+ 15 + 8	+ 22 + 12	+ 36 + 20	+ 59 + 34	+ 93 + 54	+ 153 + 90	+ 4 0	+ 7 0	+ 10 0	+ 3 − 1	+ 6 − 1	+ 9 − 1	+ 15 − 1
18	30	+ 11 + 6	+ 17 + 9	+ 28 + 16	+ 44 + 25	+ 71 + 41	+ 110 + 64	+ 178 + 104	+ 6 + 1	+ 8 0	+ 15 + 3	+ 4 − 1	+ 7 − 1	+ 11 − 1	+ 18 − 1
30	50	+ 13 + 7	+ 21 + 12	+ 33 + 19	+ 52 + 30	+ 85 + 50	+ 136 + 80	+ 212 + 124	+ 7 + 1	+ 10 + 1	+ 18 + 4	+ 5 − 1	+ 8 − 1	+ 13 − 1	+ 21 − 1
50	80	+ 16 + 9	+ 25 + 14	+ 39 + 22	+ 62 + 36	+ 102 + 60	+ 161 + 94	+ 255 + 150	+ 10 + 3	+ 13 + 2	+ 21 + 4	+ 6 − 1	+ 10 − 1	+ 16 − 1	+ 25 − 1
80	120	+ 18 + 10	+ 29 + 16	+ 45 + 26	+ 73 + 42	+ 119 + 70	+ 187 + 110	+ 297 + 174	+ 12 + 4	+ 16 + 3	+ 25 + 6	+ 7 − 1	+ 12 − 1	+ 18 − 1	+ 30 − 1
120	180	+ 21 + 12	+ 34 + 20	+ 53 + 30	+ 85 + 50	+ 136 + 80	+ 212 + 124	+ 340 + 200	+ 14 + 5	+ 20 + 6	+ 31 + 8	+ 8 − 1	+ 14 0	+ 22 − 1	+ 35 − 0

Range of Diameters mm		Maximum and Minimum Limits of Tolerance on Nominal Diameter for Reamer for Commonly Used Holes Values in μm															
Over	*Up to and Including*	K6	K7	K8	M6	M7	M8	N6	N7	N8	N9	N10	N11	P6	P7	P8	P9
1	3	− 1 − 4	− 2 − 6	− 3 − 8	− 3 − 6	− 4 − 8	—	− 5 − 8	− 6 − 10	− 7 − 12	− 8 − 17	− 10 − 24	− 13 − 34	− 7 − 10	− 8 − 12	− 9 − 14	− 10 − 19
3	6	0 − 3	+ 1 − 4	+ 2 − 5	− 3 − 6	− 2 − 7	− 1 − 8	− 7 − 10	− 6 − 11	− 5 − 12	− 5 − 16	− 8 − 25	− 12 − 39	− 11 − 14	− 10 − 15	− 15 − 22	− 17 − 28
6	10	0 − 4	+ 2 − 4	+ 2 − 6	− 5 − 9	− 3 − 9	− 3 − 11	− 9 − 13	− 7 − 13	− 7 − 15	− 6 − 19	− 9 − 30	− 14 − 46	− 14 − 18	− 12 − 18	− 19 − 27	− 21 − 34
10	18	0 − 4	+ 3 − 4	+ 3 − 7	− 6 − 10	− 3 − 10	− 3 − 13	− 11 − 15	− 8 − 15	− 8 − 18	− 7 − 23	− 11 − 36	− 17 − 56	− 17 − 21	− 14 − 21	− 23 − 33	− 25 − 41
18	30	0 − 5	+ 2 − 6	+ 5 − 7	− 6 − 11	− 4 − 12	− 1 − 13	− 13 − 18	− 11 − 19	− 8 − 20	− 8 − 27	− 13 − 43	− 20 − 66	− 20 − 25	− 18 − 26	− 27 − 39	− 30 − 49
30	50	0 − 6	+ 3 − 6	+ 6 − 8	− 7 − 13	− 4 − 13	− 1 − 15	− 15 − 21	− 12 − 21	− 9 − 23	− 10 − 32	− 15 − 50	− 24 − 80	− 24 − 30	− 21 − 30	− 32 − 46	− 36 − 58
50	80	+ 1 − 6	+ 4 − 7	+ 7 − 10	− 8 − 15	− 5 − 16	− 2 − 19	− 17 − 24	− 14 − 25	− 11 − 28	− 12 − 38	− 18 − 60	− 29 − 96	− 29 − 36	− 26 − 37	− 39 − 56	− 44 − 70
80	120	0 − 8	+ 4 − 9	+ 7 − 12	− 10 − 18	− 6 − 19	− 3 − 22	− 20 − 28	− 16 − 29	− 13 − 32	− 14 − 45	− 21 − 70	− 33 − 110	− 34 − 42	− 30 − 43	− 46 − 65	− 51 − 82
120	180	0 − 9	+ 6 − 8	+ 10 − 13	− 12 − 21	− 6 − 20	− 2 − 25	− 24 − 33	− 18 − 32	− 14 − 37	− 15 − 50	− 24 − 80	− 38 − 126	− 40 − 49	− 34 − 48	− 53 − 76	− 58 − 93

Range of Diameters mm		Maximum and Minimum Limits of Tolerance on Nominal Diameter for Reamer for Commonly Used Holes Values in μm																				
Over	Up to and Including	R6	R7	R8	S6	S7	T6	T7	U6	U7	V6	V7	X6	X7	Y7	Z7	Z8	ZA7	ZA8	ZB8	ZB9	ZC8	ZC9
1	3	− 11 − 14	− 12 − 16	− 13 − 18	− 15 − 18	− 16 − 20	—	—	− 19 − 22	− 20 − 24	—	—	− 21 − 24	− 22 − 26	—	− 28 − 32	− 29 − 34	− 34 − 38	− 35 − 40	− 43 − 48	− 44 − 53	− 63 − 68	− 64 − 73
3	6	− 14 − 17	− 13 − 18	− 18 − 25	− 18 − 21	− 17 − 22	—	—	− 22 − 25	− 21 − 26	—	—	− 27 − 30	− 26 − 31	—	− 33 − 38	− 38 − 45	− 40 − 45	− 45 − 52	− 53 − 60	− 55 − 66	− 83 − 90	− 85 − 96
6	10	− 18 − 22	− 16 − 22	− 23 − 31	− 22 − 26	− 20 − 26	—	—	− 27 − 31	− 25 − 31	—	—	− 33 − 37	− 31 − 37	—	− 39 − 45	− 46 − 54	− 49 − 55	− 56 − 64	− 71 − 79	− 73 − 86	−101 −109	−103 −116
10	14										—	—	− 39 − 43	− 36 − 43	— —	− 46 − 55	− 55 − 65	—	—	—	—	—	—
14	18	− 22 − 26	− 19 − 26	− 28 − 38	− 27 − 31	− 24 − 31	—	—	− 32 − 36	− 29 − 36	− 38 − 42	− 35 − 42	− 44 − 48	− 41 − 48	—	− 56 − 63	− 65 − 75	—	—	—	—	—	—
18	24	− 26 − 31	− 24 − 32	− 33 − 45	− 33 − 38	− 31 − 39	—	—	− 39 − 44	− 37 − 45	− 45 − 50	− 43 − 51	− 52 − 57	− 50 − 58	− 59 − 67	− 69 − 77	− 78 − 90	—	—	—	—	—	—
24	30	− 26 − 31	− 24 − 32	− 33 − 45	− 33 − 38	− 31 − 39	− 39 − 44	− 37 − 45	− 46 − 51	− 44 − 52	− 53 − 58	− 51 − 59	− 62 − 67	− 60 − 68	− 71 − 79	− 84 − 92	− 93 105	—	—	—	—	—	—
30	40						− 46 − 52	− 43 − 52	− 58 − 64	− 55 − 64	− 66 − 72	− 63 − 72	− 78 − 84	− 75 − 84	− 89 − 98	−107 −116	−118 −132	—	—	—	—	—	—
40	50	− 32 − 38	− 29 − 38	− 40 − 54	− 41 − 47	− 38 − 47	− 52 − 58	− 49 − 58	− 68 − 74	− 65 − 74	− 79 − 85	− 76 − 85	− 95 −101	− 92 −101	−109 −118	−131 −140	−142 −156	—	—	—	—	—	—
50	65	− 38 − 45	− 35 − 46	− 48 − 65	− 50 − 57	− 47 − 58	− 63 − 70	− 60 − 71	− 84 − 91	− 81 − 92	− 99 −106	− 96 −107	−119 −127	−116 −127	−138 −149	−166 −177	−179 −196	—	—	—	—	—	—
65	80	− 40 − 47	− 37 − 48	− 50 − 67	− 56 − 63	− 53 − 64	− 72 − 79	− 69 − 80	− 99 −106	− 96 −107	−117 −124	−114 −125	−143 −150	−140 −151	−168 −179	−204 −215	−217 234	—	—	—	—	—	—
80	100	− 48 − 56	− 44 − 57	− 60 − 79	− 68 − 76	− 64 − 77	− 88 − 96	− 84 − 97	−121 −129	−117 −130	−143 −151	−139 −152	−175 −193	−171 −184	−207 −220	−251 −264	−267 −286	—	—	—	—	—	—
100	120	− 51 − 59	− 47 − 60	− 63 − 82	− 76 − 84	− 72 − 85	−101 −109	− 97 −110	−141 −149	−137 −150	−169 −177	−165 −178	−207 −215	−203 −216	−247 −260	−303 −316	−319 −338	—	—	—	—	—	—
120	140	− 60 − 69	− 54 − 68	− 73 − 96	− 89 − 98	− 83 − 97	−119 −128	−113 −127	−167 −176	−161 −175	−199 −208	−193 −207	−245 −254	−239 −255	−291 −305	−356 −370	−375 −398	—	—	—	—	—	—
140	140	− 62 − 71	− 56 − 70	− 75 − 98	− 97 −106	− 91 −105	−131 −140	−125 −139	−187 −196	−181 −195	−225 −234	−219 −233	−277 −286	−271 −285	−331 −345	−406 −420	−425 −448	—	—	—	—	—	—
160	180	− 65 − 74	− 59 − 73	− 78 −101	−105 −114	− 99 −113	−143 −152	−137 −151	−207 −216	−201 −215	−249 −258	−243 −257	−307 −316	−301 −315	−371 −385	−456 −470	−475 −498	—	—	—	—	—	—

ANNEX C

(*Clause* 6.3)

TOLERANCE FOR SPECIAL REAMERS

C-1 GENERAL

Unless otherwise specified, the diameter of cutting portion of the reamer shall have a tolerance of m6. In this annex necessary information is given for determining the tolerance for the diameter of the cutting portion of the reamers where a grade of accuracy other than m6 is required. It is impossible to infer in advance the tolerance of a hole produced by a particular reamer because the actual diameter produced by the reamer depends upon a number of factors Some of the factors which influence the accuracy of the hole diameter are as follows.

a) Type and amount of the material to be removed,

b) Cutting edge design of the reamer,

c) Method of mounting and operation,

d) Condition of the reamer at the time of use, and

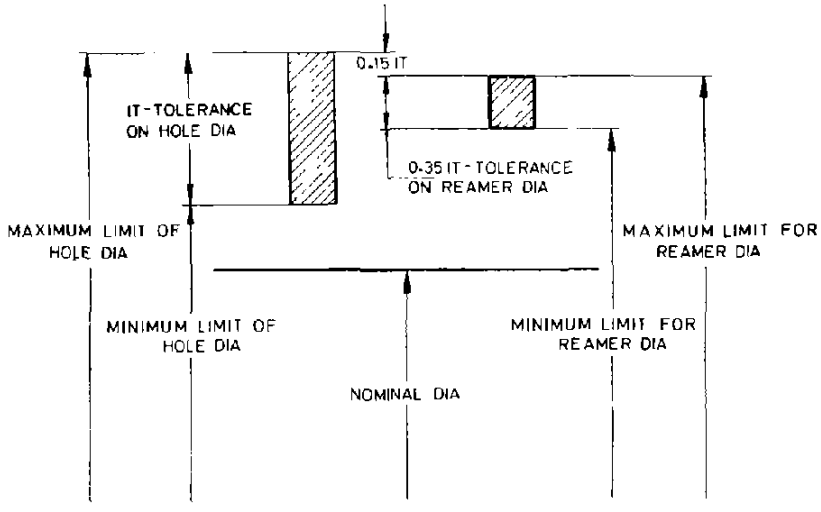
e) Lubrication.

These factors shall be taken into account while determining the special tolerance to be given on a reamer in order to get a hole of given tolerance.

C-2 METHOD OF DETERMINING THE SPECIAL TOLERANCE

C-2.1 The maximum limit for the reamer diameter = the maximum limit of the hole — 0·15 IT. The value of 0·15 IT is to be rounded to next higher value of 0 001 mm.

C-2.2 The minimum limit of the reamer diameter = the maximum limit of the reamer — 0·35 IT. The value of 0 35 IT is to be rounded to next higher value of 0 001 mm.



Example.

For a 12H7 hole

IT = 0·018 Hole size *maximum limit* = 12·018

Minimum limit = 12·000

Maximum limit of reamer diameter = Maximum limit of the hole — 0·15 IT

= 12·018 − 0·15 × 0·018 = 12·018 − 0·002 7

= 12·018 − 0·003 = 12·015

Minimum limit of reamer = Maximum limit of the reamer diameter — 0·35 IT diameter

= 12·015 − 0·35 × 0·018 = 12·015 − 0·006 3

= 12·315 − 0.007 = 12·008

ANNEX D
(*Foreword*)

COMMITTEE COMPOSITION

Drills and Reamers Sectional Committee, PE 10

Chairman	*Representing*
SHRI S. RAJAGOPALAN	Addison & Co Ltd, Madras
Members	
SHRI C VENKATESH (*Alternate* to Shri S. Rajagopalan)	
SHRI A. O. ABRAHAM	Ordnance Factory Board, Ambernath
SHRI SURESH J. BAJAJ	Universal Engineering & Manufacturing Industry, Pune
SHRI SIDHARATH J. BAJAJ (*Alternate*)	
MAJ S. BATNI	Directorate of Standardization, New Delhi
SHRI S K. ITWADI (*Alternate*)	
SHRI W. T. CHAKRAVARTHY	S R P Tools Ltd, Madras
SHRI M SAMBANDAM (*Alternate*)	
SHRI S. N. DAGA	Bharat Heavy Electricals Ltd, Bhopal
SHRI K. V. JOS (*Alternate*)	
SHRI A MADHUSUDANA RAO (*Alternate*)	
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SHRI H R GUPTA	Widia (India) Ltd, Bangalore
SHRI D. SARATHY (*Alternate*)	
SHRI I. C KHANNA	Directorate General of Supplies Disposals, New Delhi
SHRI R C SHARMA (*Alternate*)	
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SHRI B M. TAYAL (*Alternate*)	
SHRI PANDURANGAM	Central Institute of Tool Design, Hyderabad
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SHRI A. S PUNDIR	Directorate General of Technical Development, New Delhi
SHRI A MANDAL (*Alternate*)	
SHRI H. S RAMACHANDRA	Central Manufacturing Technology Institute, Bangalore
SHRI VISWANATH BHAT (*Alternate*)	
SHRI K S RAJASHEKAR (*Alternate*)	
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SHRI T. SAIDULU	HMT Ltd, Hyderabad
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SHRI S. L NAHAR (*Alternate*)	
SHRI K. S. SREEDHARA PANICKER (*Alternate*)	
SHRI R. RAMAKRISHNA (*Alternate*)	
SHRI J. P. SAXENA	Sandvik Asia Ltd, Pune
SHRI S. G. KEWANI (*Alternate*)	
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SHRI H R. SRIVATSA	Indian Telephone Industries Ltd, Bangalore
SHRI V SUBRAMANY, Director (Prod Engg)	Director General, BIS(*Ex-officio Member*)

Member Secretary
SHRI K. C. VERMA
Joint Director (Prod Engg), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition.

This Indian Standard has been developed from Doc : No. PE 10 (004).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	331 01 31, 331 13 75
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola, CALCUTTA 700054	37 84 99, 37 85 61, 37 86 26, 37 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	53 38 43, 53 16 40, 53 23 84
Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113	235 02 16, 235 04 42, 235 15 19, 235 23 15
Western : Manakalaya, E9 MIDC, Marol, Andheri (East), BOMBAY 400093	632 92 95, 632 78 58, 632 78 91, 632 78 92

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